Natural Gas

Natural gas is a clear, odorless, gaseous mixture of hydrocarbons primarily composed of methane. Natural gas is commonly used in homes for heating and cooking. In vehicles, it is used as compressed natural gas (CNG), which is stored in special cylinder tanks at 3,600 pressure per square inch or as liquefied natural gas (LNG), which is purified and condensed into a liquid by cooling it to -260°F. Natural gas is drawn from wells or extracted in conjunction with crude oil production. A similar alternative fuel can also be manufactured from decaying organic materials, such as landfill mass or manure, to produce biomethane, a substance also known as biogas.

How is it used and is it domestically produced?

According to the U.S. Department of Energy's Energy Information Administration (EIA), 84% of the natural gas used in the United States in 2007 was domestically produced. That year, 29% of the nation's natural gas was used in industrial applications, about 21% was used to heat and power homes, and .1% was used as an alternative fuel in the transportation sector.

Is natural gas safe for vehicle use?

Natural gas has been used in light- and heavy-duty natural gas vehicles (NGVs) since the mid 1960s. As with all fuels, natural gas is flammable. However, natural gas is difficult to ignite because it is lighter than air and quickly dissipates when released. Natural gas is only flammable when the fuel/air mixture is between 5% and 15%. Below 5%, there is not enough fuel for ignition, and above 15% there is not enough oxygen for ignition.

Strict safety standards are in place to ensure that NGVs are as safe or safer than conventional vehicles. NGVs are subject to the National Fire Protection Association's (NFPA) NFPA 52 Vehicular Fuel System Code, which has been adopted by most states. Natural gas tanks are made strong and durable to ensure they are safe for motor vehicle use.

How do natural gas vehicles work?

NGVs run on either LNG or CNG. LNG is typically used in heavy-duty vehicles (HDVs), while CNG is primarily used in light-duty vehicles (LDVs).

Most light-duty (and some heavy-duty) NGVs have spark-ignited engine fuel systems that work much like those of conventional cars or trucks. Basic CNG spark-ignited engine fuel system components include high-pressure fuel-storage cylinders, high-pressure fuel lines, regulators that reduce pressure to required fuel injection system levels, and special carburetors or fuel-injection systems. However, a high-pressure, direct-injection engine was recently introduced in HDVs, which burns natural gas in a compression-ignition (diesel) cycle and uses a small percentage of diesel to assist in ignition.

Do NGVs perform as well as conventional vehicles?

The acceleration, power, and cruise speeds of NGVs are comparable to similar conventional vehicles. The driving range of NGVs, however, is typically lower than that of their gasoline or diesel counterparts because natural gas has a lower storage density.

How much do NGVs cost?

Light-duty NGVs can cost $3,000 to $6,000 more than conventional vehicles, while HDVs can cost $30,000 to $50,000 more than their conventional counterparts. Price typically depends on required fuel tank capacity. However, federal and state tax credits are available to help offset the added costs of acquiring NGVs. For more information, visit the Federal and State Incentives and Laws section of the Alternative Fuels and Advanced Vehicles Data Center (AFDC) at *www.afdc.energy.gov/afdc/incentives_laws.html*.

What kinds of NGVs are available?

There are two types of NGVs: dedicated and bi-fuel. Dedicated NGVs are fueled exclusively with CNG or LNG, while bi-fuel vehicles can operate on CNG, LNG, or conventional gasoline or diesel. As of April 2008, the Honda Civic GX was the only LDV available in the United States from an original equipment manufacturer (OEM).

That doesn't mean you can't acquire an NGV. Using conversions approved by the U.S. Environmental Protection Agency or California Air Resources Board, numerous small-volume manufactures can convert a wide range of OEM vehicles to run on natural gas after OEM delivery.

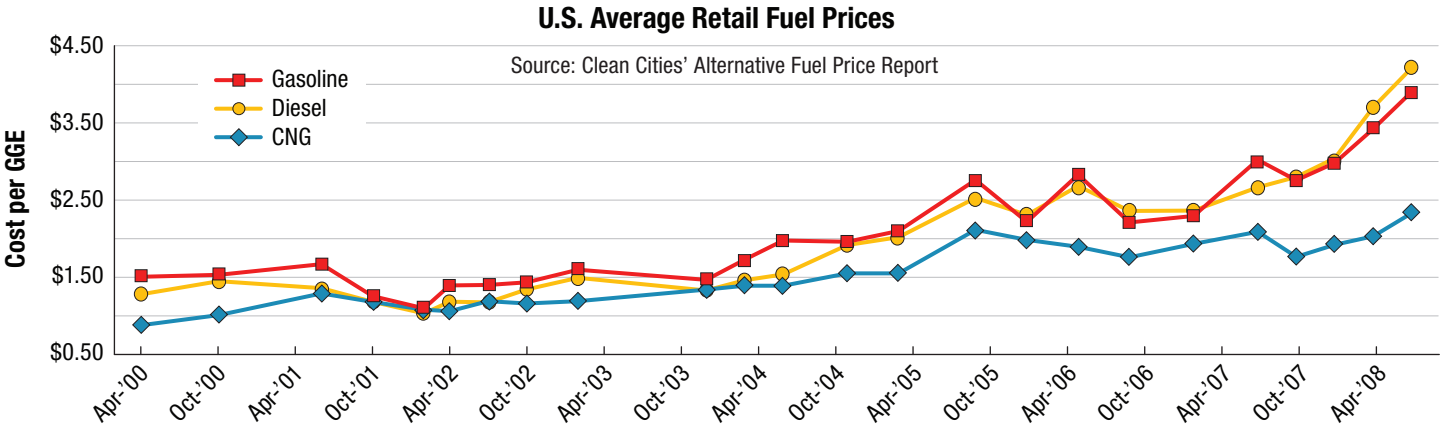

Figure 1. Although the price of CNG has shown increases over the years, it typically costs less and has smaller fluctuations and variability.

For more information on vehicle availability, visit the AFDC's Vehicle Make/Model Search section at *www.afdc.energy.gov/afdc/progs/vehicles_search.php*.

Do NGVs require special maintenance?

Some fleets have documented reduced maintenance due to the cleaner combustion process of natural gas. Operating costs are reportedly equal to or lower than conventional vehicles. Oil change frequency and exhaust system maintenance may be less frequent because natural gas typically burns cleaner.

What is the price of natural gas?

As shown in Figure 1, natural gas has historically cost less than other fuels. Natural gas prices fluctuate less than conventional fuels and are therefore more stable than gasoline and diesel.

The lower price of natural gas can help recoup the incremental cost of acquiring dedicated NGVs, which tend to be priced more than conventional vehicles (see "How much do NGVs cost?"). Vehicle and fuel tax credits and other federal and state incentives may be available. See IRS publication 510 *(www.irs.gov/publications/index.html)* and the AFDC (*www.afdc.energy.gov/afdc/incentives_laws.html*) to learn more.

Is it difficult to fuel an NGV?

No. NGVs are refueled with easy-to-use, fast-fuel or time-fill dispensers. The process for fueling NGVs is similar to that of conventional vehicles, but the dispensers feature a pressure-sealed coupling, which eliminate spills and evaporative emissions. As with all vehicles, proper safety precautions must be taken when refueling an NGV because natural gas is flammable (see "Is natural gas safe for vehicle use?").

Where is natural gas available?

According to the AFDC's Alternative Fueling Station Locator, there are 778 CNG and 38 LNG stations throughout the United States.* To find locations near you, visit *www.afdc.energy.gov/afdc/stations/find_station.php*.

Small refueling appliances that tie into residential lines are also available for purchase. For more information, visit the AFDC's Natural Gas Home Refueling section at *www.afdc.energy.gov/afdc/fuels/natural_gas_refueling.html*.

How do NGV emissions compare?

Testing indicates that vehicles using natural gas produce fewer non-methane hydrocarbons (NMHC), volatile organic compounds, particulate matter (PM), and oxides of nitrogen. Studies of carbon dioxide emissions have shown contradictory results.

Where can I get more information on natural gas?

To learn more about natural gas as a transportation fuel, visit the AFDC at *www.afdc.energy.gov/afdc/fuels/natural_gas.html*. For refueling sites in your area, visit the AFDC's Alternative Fueling Station Locator at *www.afdc.energy.gov/afdc/stations/find_station.php*.

* As of October 2008

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